



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 6

1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

APR 19 2012

Charles Curtis Grisham, Jr.
P.O. Box 31546
San Francisco, CA 94131

RE: Arkwood, Inc. Superfund Site
EPA ID: ARD084930148
Site ID: 0600124

Dear Mr. Grisham,

I am responding to your November 30, 2011, letter regarding your issues with the design and implementation of the ground water remedy at the Arkwood Superfund site. More specifically, I will address your concerns with the onsite injection system being operated by McKesson Corporation. I am providing background information on the past activities at the site so that you will have a better understanding of the groundwater remedy for the site.

The 15-acre Arkwood site is a former wood treatment facility in Boone County, Arkansas. Land use in the vicinity of the site is primarily agricultural and light industrial. Numerous springs, including New Cricket Spring, are found on, and adjacent to the site. The site is characterized as karst terrain formed by the solution of limestone and dolomite by ground water. Ground water on, or near the site is highly susceptible to contamination as a result of underground cavities, enlarged fractures and conduits which hinder monitoring and pumping. Pentachlorophenol (PCP) and creosote wood treatment activities were conducted at the site from 1962 to 1984. State investigations conducted in the 1980s documented PCP and creosote contamination in surface water, soil, debris, and buildings throughout the site. Contaminated surface features at the site included the wood treatment facility, a sinkhole area contaminated with oily waste, a ditch area, a wood storage area, and an ash pile. The primary contaminants of concern affecting the soil, sludge, debris, ground water and surface water are organics including PCP, Polycyclic Aromatic Hydrocarbons (PAHs), and dioxin: and oils.

The Record of Decision (ROD) was signed on September 28, 1990. The major components of the selected remedy for the ground water consist of:

- Onsite pumping and treatment of 3,000 gallons of oily sinkhole liquids and waste water
- Monitoring drinking water and ground water
- Providing municipal water lines to affected residence
- Monitoring New Cricket Spring for a two-year period to measure the success of natural attenuation. If PCP levels still exceed State of Arkansas water standards after two years, a treatment system will be implemented for the spring.
- Treat New Cricket Spring until levels fall below state standards.

There are currently two ground water treatment systems at the site. One is located at the New Cricket Spring location and one is located at the sinkhole area. The New Cricket Spring water

treatment system was constructed as part of the selected remedy per the September 1990 ROD. The ground water treatment system at the sinkhole location was installed as a pilot study to inject ozonated water around the sinkhole to reduce the residual PCP upstream of the New Cricket Spring and expedite the cleanup of the contaminated ground water. In February 2005, McKesson submitted a request for the pilot study involving the injection of ozonated water at the Arkwood Site. The goal was to reduce the residual PCP in the formation upstream from New Cricket Spring and thereby reduce the concentrations of PCP in the spring more quickly.

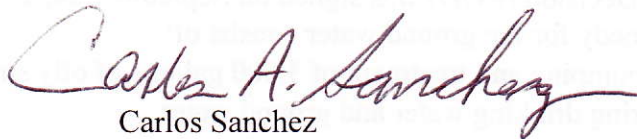
The Arkansas Department of Environmental Quality (ADEQ) responded positively to McKesson's proposal and submitted comments in March 2005. McKesson responded to ADEQ's comment by letter dated May 10, 2005. EPA approved McKesson's pilot study by letter dated July 18, 2005.

The results of the pilot injection system indicate that the injection of ozonated water around the sinkhole is effective in reducing the PCP concentration at the New Cricket Spring. The injection system has been down intermittently for months and the most recent down time resulted in PCP concentration increasing at the New Cricket Spring. The levels at the mouth of New Cricket Spring are at concentrations that are not constantly below ADEQ's water surface criteria and therefore, EPA believes that injection of ozonated water should continue at the sinkhole location. Also, treatment of the water emanating from New Cricket Spring should continue before the water is released to Cricket Creek. I am enclosing responses to your specific questions and information related to those responses.

In a separate letter, I will provide an update on the status of the Five Year Review comments you submitted that we discussed with you at a meeting with EPA and ADEQ on November 9, 2011. At that meeting, we went over your comments and EPA and ADEQ provided information and action items to address your comments.

Regarding your request for partial deletion of the Arkwood site, EPA will be sending a letter to ADEQ the week of April 23, 2012, requesting their approval for partial deletion of the Arkwood Superfund site. In the mean time, EPA will be preparing the draft deletion package that will be sent out for review and comments.

Sincerely,



Carlos Sanchez

Chief

Superfund AR/TX Remedial Section

Enclosure

For clarity, when I speak of the "injection system" I am referring to the onsite part of the groundwater remediation, which Mr. Ghose describes in his August 2, 2010, update as quoted below:

"Responsible Party (R.P), McKesson started a pilot study, injecting ozonated water near the sinkhole to speed up reduction of PCP in the formation upstream from the New Cricket Spring. The pilot project started by the summer of 2005. This process will ensure that the PCP will be destroyed in the subsurface fractures near the New Cricket Spring and the site can be deleted from the National Priorities List (NPL). The injection of ozonated water continues as of February 2007. Injection was stopped by August 2007 and resumed in September 2007. Immediately after resumption of injection of ozonated water PCP at the mouth of New Cricket Spring was 200+ ppb. To expedite cleaning up residual PCP in fractures McKesson started 5 additional injection wells around the sinkhole in mid September 2007. McKesson will wait and see if the PCP concentration will diminish at the New Cricket Spring."

Following are some of the key issues I will be researching in the EPA and ADEQ public files. I request that you and your EPA colleagues assist with my research by providing any answers that may be readily available to you.

1. Were designs, construction plans and scientific proof-of-concept submitted to EPA prior to McKesson's installation of the "injection system?"

EPA Response: The ozonated water injection system was proposed by McKesson as a pilot study. McKesson submitted the Proposal for the Ozone Pilot System in February 2005. The proposal included the system description, equipment specifications, and other system information (attachment #1).

2. Did EPA approve the "injection system" prior to its installation on the Arkwood property by McKesson Corporation?

EPA Response: Yes, EPA approved the pilot injection system by letter dated July 18, 2005 (attachment #2).

3. What scientific data and analysis were used to arrive at the design and specifications of the "injection system?"

EPA Response: McKesson proposed the pilot ozonated injection system based on the results of using ozone in treating the New Cricket Spring water since 1997. The proposal submitted by McKesson in February 2005, included system and equipment specifications.

4. What proof exists to support Mr. Ghose's assertion quoted above: "This process will ensure that the PCP will be destroyed in the subsurface fractures near the New Cricket Spring and the site can be deleted from the National Priorities List (NPL)."

EPA Response: Mr. Ghose's statement refers to the goals that the system is intended to achieve. The assumption is that if the system works as intended and the PCP levels in New Cricket Spring meet the Arkansas's Surface Water Standards, then the site can be deleted from the NPL.

5. Mr. Ghose is quoted above: "The injection of ozonated water continues as of February 2007. Injection was stopped by August 2007 and resumed in September 2007." When exactly was the injection stopped and restarted?

EPA Response: The injection system was temporarily stopped from August to September 2007 to assess rebound affects.

6. Mr. Ghose is quoted above: "Immediately after resumption of injection of ozonated water PCP at the mouth of New Cricket Spring was 200+ ppb." Is this one data point considered to be proof of the efficacy of the injection system?

EPA Response: The 200+ ppb reading is one of many samples that have been collected since the system was installed in 2007. The sampling PCP levels have fluctuated up and down since 2007, but the overall trends have been decreasing. This indicates that the pilot injection system is working as intended.

7. Why does Mr. Ghose not mention the following readings, which were also taken right after resumption of the injection operations (all with the spring at the exact same flow rate of 18 gallons per minute) and which show no correlation between injection operations and low readings: 9/24/2007: 16 ppb; 10/10/27: 6 ppb; 10/22/2007: 1190 ppb; 11/5/2007: 209 ppb?

EPA Response: The subsurface karts and fractured rock formation make it difficult to get consistent reading with the same flow rate. As stated in question #6, the PCP levels fluctuate and probably will continue to fluctuate, but the overall thread is decreasing.

8. Mr. Ghose is quoted above: "To expedite cleaning up residual PCP in fractures McKesson started 5 additional injection wells around the sinkhole in mid September 2007." Were designs, construction plans and scientific proof-of concept submitted to EPA prior to McKesson's installation of 5 additional injection wells?

EPA Response: McKesson's proposal to install five additional injection wells was based on the assumption that a larger area of subsurface fractures would come in contact with the ozonated water.

9. Was the additional invasive construction of five injection wells on the Arkwood site approved in advance by EPA, or was it undertaken by McKesson Corporation without agency approval, permission or consent?

EPA Response: EPA agreed with the installation of the five additional injection wells based on the assumption proposed by McKesson.

10. Soon after "McKesson started 5 additional injection wells around the sinkhole in mid September 2007" the concentrations of PCP at New Cricket Spring spiked to an all time high of 1190 ppb (October 2007). Is this evidence that McKesson Corporation's construction of the 5 additional wells caused a release of contaminant, inflicting possible ecological and property damage, exacerbating the contamination problem and hampering the groundwater remediation efforts?

EPA Response: The high PCP reading after the additional injection wells were installed, indicate that the injection of ozonated is achieving its intended goals of flushing out the PCP contaminants that are trapped in subsurface karts and fractured rock geology. That was the purpose of installing the additional wells, to expedite the removal of the PCP from the subsurface karts and fractured rock formation.

I have many more questions about the design, construction, operation and reporting of the groundwater remediation systems on the Arkwood site and nearby at New Cricket Spring; about any unilateral actions taken by McKesson Corporation without required and appropriate EPA involvement; and about EPA oversight and scrutiny (or lack thereof) given to McKesson Corporation's activities at Arkwood with regard to the groundwater remediation.

EPA Response: McKesson has not conducted unilateral actions at the site without EPA and ADEQ review. EPA, with the support of ADEQ, is conducting appropriate oversight of McKesson's cleanup activities at the Arkwood Superfund site.

I request that EPA review these matters to check for scientific validity and correct procedure in the implementation and justification of the existing groundwater remedy at the Arkwood, Inc. Superfund site.

EPA Response: EPA believes that information was provided for EPA to approve the pilot ozonated water injection system. The system appears to be working and the contaminant levels are trending downward. As stated above, the site activities associated with the water injection system were conducted as a pilot. Some actions did not include analyses, but were based on other site activities as mentioned above.

Certified Mail

February 1, 2005

Mr. Shawn Ghose, EPA Project Coordinator
Superfund AR/LA Enforcement Section (6SF-AP)
U.S. Environmental Protection Agency
1445 Ross Avenue
Dallas, Texas 75202

**Subject: Proposed Ozone Pilot System
Arkwood, Inc. Site, Omaha, Arkansas**

Dear Mr. Ghose:

McKesson would like to conduct a pilot study involving the injection of ozonated water at the Arkwood Site. Although concentrations of pentachlorophenol (PCP) have decreased at New Cricket Spring, reductions are limited to natural attenuation. If the residual PCP in the formation upstream from the spring is reduced, it is anticipated that concentrations of PCP at New Cricket Spring will be reduced more quickly. Attached is a proposal to conduct a pilot study using an ozone system similar to the present treatment system at the site. Upon your approval of this concept, design specifications and an implementation schedule will be developed. Following completion of the study, a report presenting results will be prepared and submitted to the agencies.

If you have any questions regarding this proposal or need additional information, please do not hesitate to contact me at (608) 848-4134.

Sincerely,

Jean A. Mescher, Project Coordinator
Director, Environmental Services

Enclosure

Copy:

- v EPA Assistant Regional Counsel (6C-WA)* (w/o enclosure)
- v Chief, Superfund Enforcement Branch (6H-E)* (w/o enclosure)
- v Arkansas Superfund Site Coordinator, ADPC&E*
- v Frank Robinson, McKesson Corporation. (w/o enclosure)

* CERTIFIED MAIL

Proposal

Ozone Pilot System

Arkwood Site, Inc.
Cricket Creek Road
Omaha, AR

February 2005

Arkwood Pilot System:

System description:

The System will be designed to ozonate 30 to 40 gallons per minute of water from two existing wells, so that the ozone laden water can be returned to the aquifer. The ozonated water ideally will assist in oxidizing PCP as well as freeing PCP existing in the formation for treatment downstream. Typically, direct ozonation reactions selectively target double carbon bonds.

The ozone equipment will be located in an existing building within a silo at the Arkwood site.

The system will include an ozone generator and oxygen concentrator for production of ozone from oxygen feed gas, a mass transfer system for dissolution of the ozone gas into groundwater, an off gas destruct unit for converting any non dissolved ozone back into oxygen, and a control and monitoring system – designed for a manual start of the system, automatic shutdown for key operating parameters, and measuring and recording ozone production, water flow, and ozone residuals.

The ozone system will be designed for an initial capacity of 12 PPD of ozone, which will allow for an ozone dosage of up to 33 mg/l of applied ozone to the groundwater. Should additional ozone capacity be desired in the future, the ozone generator has the capacity to be increased to 16 to 20 PPD ozone by increasing the oxygen flow to the ozone generator (additional mass transfer system modifications would be required to accommodate the additional flows).

Equipment specifications:

Ozone Generator

The ozone generator shall be a corona discharge, water cooled ozone generator, with high efficiency stainless steel/borosilicate glass dielectric assemblies and integrated medium, frequency power supply. The ozone generator shall be a PCI-Wedeco model GSO 50

Capacity: Nominal capacity of 16 PPD ozone @ 10% by wt in oxygen
12 PPD ozone @ 12% by wt. in oxygen
24 PPD ozone @ 6% by wt in oxygen

Dimensions: 36" wide x 19" deep x 64" high

Utilities: Oxygen - 1 scfm oxygen at 25 psig
Cooling water - 3 gpm, potable quality, 68°F

Power - 460 volt, 3 phase, 5.4 amps

Connections: Oxygen inlet: ½" FNPT
Ozone Outlet ½" FNPT
Cooling Water Inlet ½" FNPT
Cooling Water Outlet ½" FNPT

Compressor/oxygen concentrator Skid

The compressor/oxygen concentrator skid includes a rotary screw compressor, air receiver, oxygen concentrator, oxygen surge tank, factory skid mounted and pre-plumbed.

The compressor shall be a rotary screw compressor , providing optimum performance, the compressor shall be an Atlas Copco GXC5FF Compressor with integrated of refrigerant dryer, compressed air filters and a 53 gallon air tank .

The oxygen concentrator shall be a twin bed molecular sieve based oxygen concentrator, plc controlled with a capacity of 75 scfh of oxygen at 93% purity or higher. The oxygen concentrator shall be an OGSi model OG-75

The oxygen storage tank shall be an 80 gallon storage tank complete with pressure gauge, relief valve oxygen pressure regulator, and oxygen hoses.

Dimensions: 60" x 84"

Utilities: 460 volts, 3 phase, 12 amps

Mass Transfer Skid

The mass transfer skid consists of a booster pump, venturi injector with flow bypass, contact tank, degassing separator, and off gas relief valve. Instrumentation located on the mass transfer skid shall be a residual ozone analyzer and a totalizing flow meter, both with 4-20 mA outputs to a circular chart recorder.

Dimensions: 48" x 60"

Utilities: 460 volts, 3 phase, 4 amps

Off Gas Destruct Unit

Destruct unit shall be a catalytic type off gas destruct unit with thermal assist. The catalyst shall be Carulite 200, a manganese dioxide/copper oxide catalyst for efficient ozone destruction. Destruct unit shall be rated for 600 scfh. Pre-heater shall be rated at 150 watts.

Utilities: 120 Volts, single phase, 150 watts

Residual ozone analyzer

The residual ozone analyzer shall be designed to continuously monitor ozone residual at the effluent of the mass transfer system. The ozone sensor shall be a direct measuring polarographic sensor utilizing a special polymeric membrane to isolate the sensing electrodes from the sample.

The Dissolve Ozone Monitor shall provide a display of the dissolved ozone concentration directly in PPM on a backlit LCD display. The monitor shall have a range of up to 20 mg/l residual ozone. The monitor shall have a 4-20 mA output and two programmable alarm contacts. The monitor shall be housed on a NEMA 4X fiberglass enclosure.

The dissolved ozone sensor shall be mounted in a gravity fed flow cell with a flow rate of 15 gallons per hour of sample, with discharge to drain.

High Concentration Ozone Analyzer

The high concentration ozone monitor shall be a UV absorption, dual beam photometer with a long life mercury vapor lamp ozone concentration monitor with a microprocessor controlled 254 nm UV light source & photoreceptor, with inlet filtration and flow control. Range of 0-200 g/Nm³.

System Control Panel

The system control panel shall be designed to start, stop, and shut down the system in the event of alarm conditions. The panel shall be NEMA 4 fiberglass enclosure, and fabricated to UL 508 standards.

The equipment to be controlled by the control panel includes:

- Air Compressor/Oxygen Concentrator skid
- Ozone Generator
- Mass transfer skid
- Off gas destruct unit
- Ambient ozone detector

The control panel will include a main disconnect, emergency stop, and the following panel indicators/operators:

- Panel Indicators(annunciator: Panalarm or Ronan)
 - System ON
 - Generator On
 - Oxygen Concentrator On
 - Alarm Lights
 - Low well flow
 - Loss of vacuum
 - Backflow failure
 - Ozone Generator failure
 - Ambient ozone alarm

(Note: Generator failures indicated on Generator panel will be:

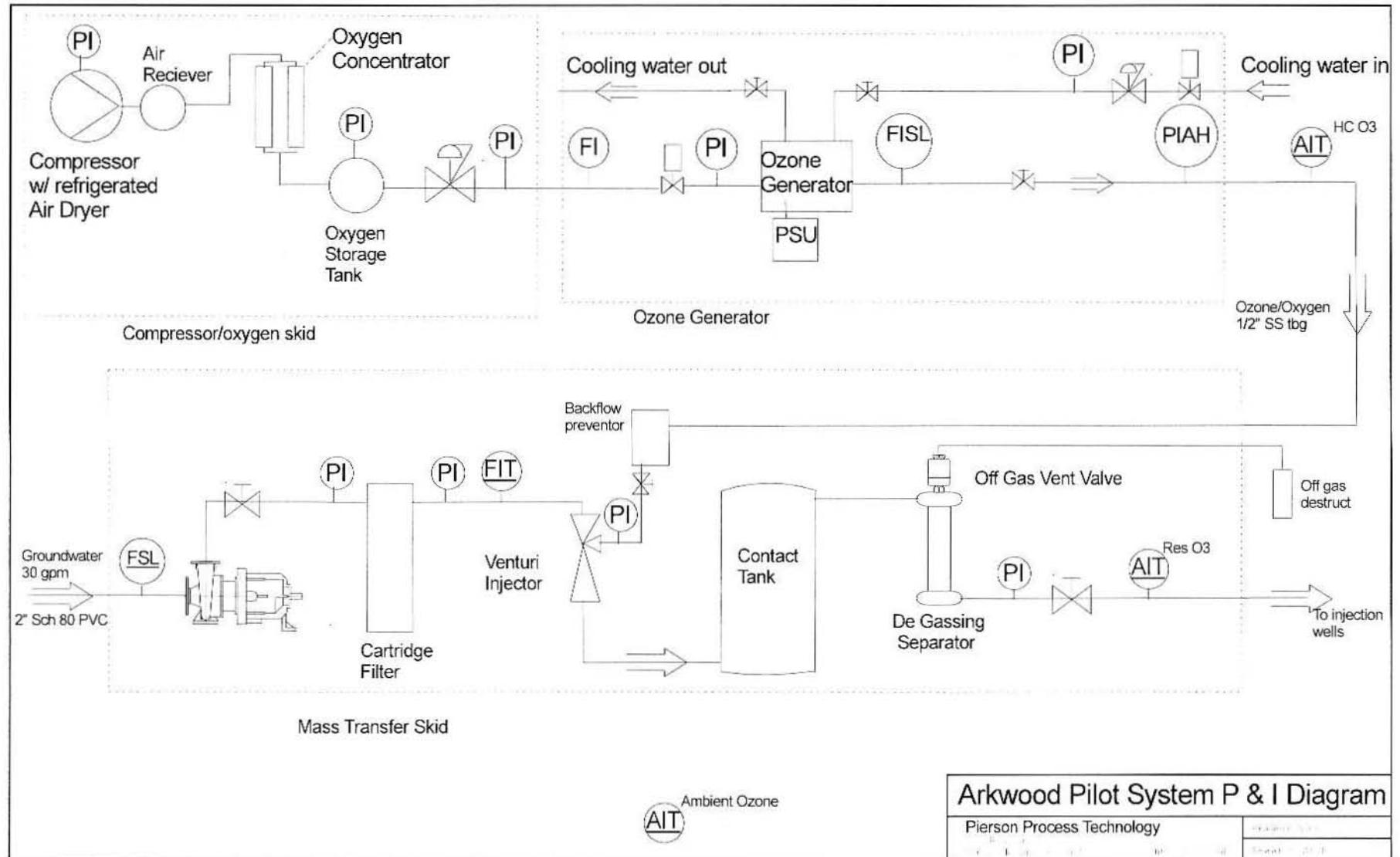
High water temp, low oxygen flow, power supply fault,
Power supply high temp)

- Selector switches:

System Start/off	On/Off
Ozone Generator	Hand/off/auto
Oxygen concentrator	Hand/Off/Auto
Mass transfer Skid	Hand/Off/Auto
Off gas destruct	Hand/Off/Auto

Ambient Ozone Detector

The ambient ozone detector shall be an electrochemical ozone gas sensor that will create a signal proportional to the ozone concentration present, mounted in a fiberglass enclosure. The receiver shall have an LED display to indicate ambient ozone levels in parts per million as well as flashing indicators if adjustable alarm contact set points are exceeded.



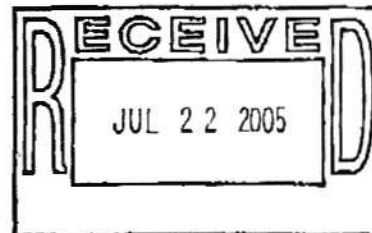


UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 6

1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

JUL 18 2005



Ms. Jean Mescher
McKeeson Corporation
One Post Street
San Francisco, CA 94104

Dear Ms Mescher:

The U.S. Environmental Protection Agency (EPA) commends McKeeson's proposal to conduct a pilot study to inject ozonated water around the sink hole, to reduce the residual PCP upstream of the New Cricket Spring. McKeeson's idea that reduction of residual PCP upstream of the spring will accelerate lowering PCP concentration in the New Cricket Spring is on the right track. EPA is satisfied with the information provided regarding the locations of injection wells, construction details of injection wells, rationale for choosing depth of injection wells, and rate at which ozone is to be injected. EPA approves McKeeson's pilot study.

Please keep us informed about the progress.

Sincerely yours,

A handwritten signature in cursive script, appearing to read "Santanu Ghose".

Santanu (Shawn) Ghose
Remedial Project Manager
Superfund Arkansas/Texas Branch

cc: Gus Chavarria
Gloria Moran, 6RC-S

ADEQ

ARKANSAS
Department of Environmental Quality

March 2, 2005

Jean Mescher, Project Coordinator
McKesson Corporation
One Post Street
San Francisco, CA 94104-5296

RE: Proposed Ozone Pilot System
Arkwood, Inc. Site, Omaha, Arkansas

Dear Ms. Mescher:

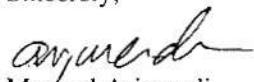
Your proposal to conduct a pilot study injecting ozonated water at the Arkwood Site was received by ADEQ on February 9, 2005. ADEQ admires your initiative to try to reduce/eliminate the source of PCP contamination of the New Cricket Spring.

We feel that since McKesson is going to submit design specifications and an implementation schedule, our questions/comments may be already answered in the specifications when it is submitted. However, the following are our review comment/questions on your proposal.

1. Provide a map showing locations of injection wells.
2. Provide construction details of injection wells.
3. Provide rationale for choosing the depth of the injection wells to be approximately 25 feet.
4. Specify rates and amount of ozone to be injected; and, flow directions (inflow and outflow from the site) of the spring
5. Provide specific breakdown pathways, both intermediate and final for oxidation of the PCP. The example in the proposal is for the oxidation of ethene to formaldehyde. Show how PCP would be oxidized or the resulting compounds. Would Cl ions or HCl be formed? How will that affect the pH?

If you have any questions, please call me at (501) 682-0852.

Sincerely,



Masoud Arjmandi
Engineer II, Inactive Sites Branch, Hazardous Waste Division

CC: Mike Bates, Chief, HWD
Shawn Ghose, EPA RPM, Region 6, 6SF-AP
Kin Siew, Engineer Supervisor, Inactive Sites Branch, HWD
Jerry Neill, Geologist, P.G., Inactive Sites Branch, HWD

HAZARDOUS WASTE DIVISION

8001 NATIONAL DRIVE / POST OFFICE BOX 8913 / LITTLE ROCK, ARKANSAS 72219-8913 / TELEPHONE 501-682-0833 / FAX 501-682-0565
www.ndeq.state.ar.us

May 10, 2005

Mr. Masoud Arjmandi
Arkansas Department of Environmental Quality
Hazardous Waste Division
8001 National Drive
Little Rock, AR 72219

Subject: **Response to Comments**
 Proposed Ozone Pilot System
 Arkwood, Inc. Site, Omaha, AR

Dear Mr. Arjmandi:

In response to your comments dated March 2, 2005 on our proposed ozone pilot system, please see the following (*ADEQ comments in bold italic*, responses follow):

- 1) ***Provide a map showing the locations of injection wells.*** The wells will be placed to intersect the solution channel features that flow toward New Cricket Spring. The wells will be located approximately 25 feet and 50 feet from the sink hole, between the sink hole and the main power pole at the site. A map showing the approximate well locations is attached (Figure 1). The location was chosen based on subsurface features observed during investigation and remediation activities at the site.
- 2) ***Provide construction details of injection wells.*** The wells will be constructed of 6-inch PVC with the lower 10 feet perforated to allow water flow through the lower section of the well. The wells will pass through about 12-18 feet of clay and into 7-13 feet of fractured chert based on previous borings. A rubber bladder will be set approximately 10 feet below ground surface and the area between the casing and drilled hole will be filled with bentonite grout.
- 3) ***Provide rationale for choosing the depth of the injection wells to be approximately 25 feet.*** Based on site investigations and remediation, bedrock in this area is located about 25 feet below the ground surface.
- 4) ***Specify rates and amount of ozone to be injected; and, flow directions (inflow and outflow from the site) of the spring.*** The pilot system will ozonate approximately 30 to 40 gallons per minute of water at a dosage rate of up to 33/mg/l ozone. The ozonated water will be injected into wells installed in the vicinity of the former sinkhole. Based on monitored contaminant discharge (PCP) from the site, the injected ozonated water will flow toward New Cricket Spring. For your reference, a P&I diagram is attached as Figure 2.

5) *Provide specific breakdown pathways, both intermediate and final for oxidation of the PCP. The example in the proposal is for the oxidation of ethane to formaldehyde. Show how PCP would be oxidized or the resulting compound. Would CL ions or HCL be formed? How will that affect pH?* Pentachlorophenol (PCP) is readily ozonated by ozone. Reaction rates and subsequent degradation products are to a degree pH dependent, with neutral to basic environments reacting faster than in acidic environments. The primary mechanism of oxidation is direct electro-philic attack of ozone through an addition/elimination mechanism. Initial intermediate degradation products are principally tetrachloro-p-benzoquinone and tetrachloro-p-hydroquinone. These compounds are further degraded by ozone and hydroxyl radicals (a byproduct of ozone decomposition) to other open ring products including ketones and acids that are further oxidized to oxalic acid with a quantitative release of chloride ions. In summary, oxidation of PCP results in low molecular weight acids, chloride ions, CO₂ and water. Ozonation of PCP has a negligible effect on pH.

If you have any additional questions, please call me at (608) 848-4134. We look forward to conducting the pilot activities this summer.

Sincerely,

Jean Mescher, Project Coordinator
Director, Environmental Services

Attachments

Copy:

- Shawn Ghose, EPA Project Coordinator (certified mail)
- Frank Robinson (w/o attachments)